

Sandia National Laboratories and the Electric Power Research Institute (EPRI) are pleased to host the

## 2<sup>nd</sup> PV Performance Modeling Workshop



Photo courtesy of Semptra Energy

**Dates:** 1:00 PM to 5:00 PM, Wednesday, May 1, 2013 (Lunch\* at 12)  
with special evening session 7:00 to 9:00 pm  
8:00 AM to 5:00 PM, Thursday, May 2, 2013 (Breakfast at 7)

**Location:** The Biltmore Hotel, 2151 Laurelwood Road, Santa Clara, CA

*Credible estimates of PV system output are critical to successful development of large-scale PV projects. This workshop will provide information on advances in modeling, on pathways to reducing variability in model input and output, and on opportunities for standardizing modeling practice and reducing project risk.*

## Revised Draft Agenda: Wednesday, May 1

**Lunch (*Reservation Required*\*)** **12:00 pm**

**Registration** **12:30 pm**

**Welcome & Introduction: Why Are We Here?** **1:00 pm**

An overview of the workshop will be presented, along with intended outcomes, goals and next steps.

- Welcome and Purpose Josh Stein, Sandia National Laboratories
- Summary of Previous Workshop Chris Cameron, Independent Consultant

**Module Models: Generating Performance Coefficients** **1:30 pm**

The selection of a module performance algorithm and associated module performance coefficients is a critical step in modeling system performance. These presentations will emphasize the process for deriving performance coefficients from test data.

- User Experience with Module Performance Coefficients Bradley Hibberd, Borrego Solar
- Generating Module Coefficients for Sandia Array Performance Model Cliff Hansen, Sandia
- Generating Module Coefficients for SAM/CEC n-parameter model Aron Dobos, NREL
- Generating Module Coefficients for PVsyst Evan Riley, Black & Veatch
- Generating Module Coefficients for PVsyst and PV\*SOL Ken Sauer, Yingli Green Energy Americas

**Break** **2:45 pm**

**Module Models (concluded)** **3:00 pm**

- Changes in Module Performance Coefficient Generation for Version 6 André Mermoud, PVsyst
- Generating Module Coefficients: Blind Study Results Cliff Hansen, Sandia
- Discussion – Reducing Variability in Module Performance Coefficient Generation
- Performance Matrices per IEC 61853 Standards: Their Importance for the Energy Estimation Models Mani G. Tamizhmani, ASU PRL and TUV Rheinland PTL
- The Sensitivity and Limitations of Present and Alternative PV Models Steve Ransome, SRCL
- Discussion

**Dinner (On Your Own)** **5:00 pm**

**PV System Performance Models** **7:00 pm**

Developers of system models will present overviews or demonstrations of their models.

- PVsyst André Mermoud, PVsyst
- HelioScope Paul Grana, Folsom Labs
- PVSIM Mike Anderson, SunPower
- System Advisor Model Aron Dobos and Nate Blair, NREL
- PV\*SOL Bernhard Gatzka, PV\*SOL® from Valentin Software

**End of Day 1** **9:00 pm**

\* All registrants will receive an email invitation to the Wednesday lunch from the workshop organizers. Lunch on Wednesday will only be available to those who accept the email invitation. Breakfast and lunch on Thursday are open to all registrants.

## Revised Draft Agenda: Thursday, May 2

<b>Breakfast</b>	<b>7:00 am</b>
<b>Solar Resource Data</b>	<b>8:00 am</b>
The expected solar resource at a site is critical to establishing project viability. This session will present methods to reduce project risk by addressing bias and uncertainty in solar resource data.	
<ul style="list-style-type: none"> <li>A Review of Measured/Modeled Solar Resource Uncertainty</li> <li>Reducing Solar Resource Error Through On-Site Monitoring</li> <li>Quantifying Uncertainty in Solar Energy Estimates</li> <li>Improving Estimation of Plane-of-Array Irradiance</li> <li>Diffuse Irradiance and Backtracking in Tracker Systems</li> <li>Discussion – Reducing Solar Resource Error and Uncertainty</li> </ul>	<p>Thomas Stoffel, NREL</p> <p>Marie Schnitzer, AWS Truepower</p> <p>Kevin Lang, SAIC</p> <p>Ben Bourne, SunPower</p> <p>Bodo Littman, First Solar</p>
<b>Break</b>	<b>10:00 am</b>
<b>System Losses and Derates</b>	<b>10:15 am</b>
Estimates of system losses vary greatly among models and modelers. This session will seek to improve our understanding of system losses and the means of modeling them.	
<ul style="list-style-type: none"> <li>Draft Definitions of System Loss Factors</li> </ul>	Geoff Klise, Sandia
<b>Mismatch Losses</b>	
<ul style="list-style-type: none"> <li>Quantifying Mismatch Losses in Small Arrays</li> <li>Calculation of Mismatch Losses due to Shading in PVsyst, v6</li> <li>Modeling Mismatch Losses in HelioScope</li> <li>Calculating Model Shading Inputs from Design Data</li> <li>Discussion – Standardizing Definitions of Mismatch Losses</li> </ul>	<p>Sara MacAlpine, U. of Colorado</p> <p>André Mermoud, PVsyst</p> <p>Paul Grana, Folsom Labs</p> <p>Tarn Yates, Borrego Solar</p>
<b>Lunch</b>	<b>11:45 pm</b>
<b>System Losses and Derates (concluded)</b>	<b>12:45 pm</b>
<b>Panel Discussion: System Losses and Derates</b>	
<ul style="list-style-type: none"> <li>Jeff Roche, SunPower; Paul Gibbs, Folsom Labs; Rob Andrews, Queens U.; Alex Panchula, First Solar</li> <li>Discussion – Standardizing System Loss Factor Definitions</li> </ul>	
<b>Performance Degradation</b>	
<ul style="list-style-type: none"> <li>Modeling Module Power Degradation</li> <li>Fleet-Wide Study of System Degradation</li> <li>Standardizing Definitions: Survey Results and Inputs to the Working Group</li> </ul>	<p>Thomas Roessler, Yingli Green Energy Europe</p> <p>Mike Anderson, SunPower</p> <p>Geoff Klise, Sandia</p>
<b>Break</b>	<b>2:45 pm</b>
<b>Modeling in the Real World</b>	<b>3:00 pm</b>
<ul style="list-style-type: none"> <li>Modeling Needs for Performance Guarantees</li> <li>Model Validation Methodology and Results</li> <li>Improving PV Performance Models using Real World Data</li> <li>Climatically Diverse Data Set for Flat-Plate PV Module Model Validations</li> <li>Standards for Acceptance Testing and Model Validation</li> </ul>	<p>Alex Panchula, First Solar</p> <p>Mike Anderson, SunPower</p> <p>Jürgen Sutterlueti, TEL Solar</p> <p>Bill Marion, NREL</p> <p>Evan Riley, Black &amp; Veatch</p>
<b>Discussion and Wrap-Up</b>	<b>4:30 pm</b>
<ul style="list-style-type: none"> <li>Summary Discussion – Uncertainty in System Output Estimates</li> <li>Wrap-Up and Next Steps</li> </ul>	<p>Cliff Hansen, Sandia</p> <p>Josh Stein, Sandia</p>
<b>Adjourn</b>	<b>5:00 pm</b>